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The lower mantle is considered mainly consisting of (Fe,Mg)SiO₃ perovskite and MgO periclase. As one of the studies on rheological properties of mantle minerals[1,2], we carried out the stress measurement on perovskite and periclase in the T-cup press. In our previous study, we have found that the upper mantle mineral olivine is much weaker than the transition zone minerals, wadsleyite and ringwoodite, especially when water is present. Rheological properties of lower mantle minerals are important for constraining mantle convection and understanding the origin of deep focus earthquakes.

The perovskite sample was synthesized at 26 GPa and 1800°C using the USSA2000 press at Stony Brook. The structure was confirmed by x-ray diffraction before the experiment. The powdered sample was first compressed up to 20 GPa at room temperature and then was heated up to 1000°C stepwise. At each heating step the temperature was held for several tens of minutes during which diffraction data are recorded as a function of time. The results are shown in Figure 1 and Figure 2. The perovskite and periclase have quite different rheological properties, the perovskite is very strong and the periclase is very weak.

Although the perovskite shows very strong rheological behavior, the lower mantle may still have weak characteristics since MgO is much weaker, being comparable to olivine. Results of the rheological study on the mantle minerals, olivine, wadsleyite, ringwoodite, perovskite and MgO may constrain the origin of the deep focus earthquakes in terms of storage of stress.

[1] J. Chen, T. Inoue, Y. Wu, D. J. Weidner and M. T. Vaughan, NSLS Report 1996 B-139.

[2] J. Chen, D. J. Weidner, T. Inoue, H. Kagi and M. T. Vaughan, in this Report (X17B1).

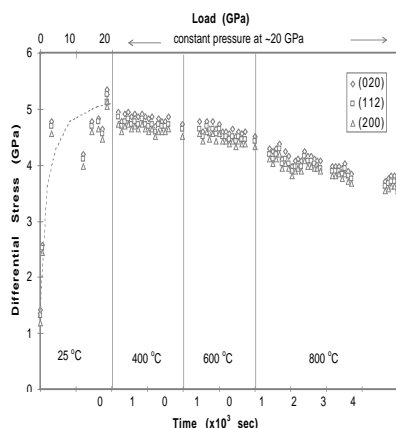


Figure 1. Stress in the perovskite.

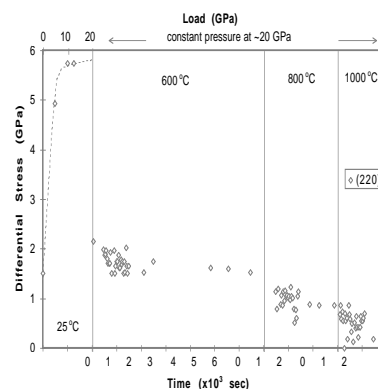


Figure 2. Stress in the periclase.